Engineered microenvironments for self-renewal and musculoskeletal differentiation of stem cells.

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Authors: Yongsung Hwang, Ameya Phadke, Shyni Varghese

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Public Summary:
This review describes the role of microenvironment on self-renewal and differentiation of stem cells.

Scientific Abstract:
Stem cells hold great promise for therapies aimed at regenerating damaged tissue, drug screening and studying in vitro models of human disease. However, many challenges remain before these applications can become a reality. One such challenge is developing chemically defined and scalable culture conditions for derivation and expansion of clinically viable human pluripotent stem cells, as well as controlling their differentiation with high specificity. Interaction of stem cells with their extracellular microenvironment plays an important role in determining their differentiation commitment and functions. Regenerative medicine approaches integrating cell-matrix and cell-cell interactions, and soluble factors could lead to development of robust microenvironments to control various cellular responses. Indeed, several of these recent developments have provided significant insight into the design of microenvironments that can elicit the targeted cellular response. In this article, we will focus on some of these developments with an emphasis on matrix-mediated expansion of human pluripotent stem cells while maintaining their pluripotency. We will also discuss the role of matrix-based cues and cell-cell interactions in the form of soluble signals in directing stem cell differentiation into musculoskeletal lineages.